

SEQUENCE LISTING

<110> Benning, Christoph

Sanda, Sherrie

Yu, Bin

<120> Compositions and Methods for the Synthesis and Subsequent Modification of Uridine-5-Diphosphosulfoquinovose (UDP-SQ)

<130> MSU-04769

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<170> PatentIn version 3.0

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| Met | Arg | Ile | Ala | Leu | Phe | Thr | Glu | Thr | Phe | Leu | Pro | Lys | Val | Asp | Gly | |
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| | | | | | | | | | | | | | | | | |
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| atc | gtc | acg | cgg | ctt | cgg | cac | acg | gtc | gat | cac | ctg | cag | cgt | ctt | ggc | 96 |
| Ile | Val | Thr | Arg | Leu | Arg | His | Thr | Val | Asp | His | Leu | Gln | Arg | Leu | Gly | |
| | | | 20 | | | | | 25 | | | | | 30 | | | |

| | | | | | | | | | | | | | | | | |
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| cac | acc | gtc | atg | gtt | ttt | tgc | ccc | gac | ggc | ggg | ctc | cgc | gag | cac | aag | 144 |
| His | Thr | Val | Met | Val | Phe | Cys | Pro | Asp | Gly | Gly | Leu | Arg | Glu | His | Lys | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |

| | | | | | | | | | | | | | | | | |
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| ggg | gct | cga | gtc | tat | ggg | gtt | aaa | ggc | ttt | ccg | cta | ccg | ctc | tat | ccc | 192 |
| Gly | Ala | Arg | Val | Tyr | Gly | Val | Lys | Gly | Phe | Pro | Leu | Pro | Leu | Tyr | Pro | |
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| | | | | | | | | | | | | | | | | |
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| gag | ctg | aag | cta | gct | ttt | ccg | ttg | ccg | aaa | gtg | gga | aaa | gcc | ttg | gag | 240 |
| Glu | Leu | Lys | Leu | Ala | Phe | Pro | Leu | Pro | Lys | Val | Gly | Lys | Ala | Leu | Glu | |
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| | | | | | | | | | | | | | | | | |
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| cgg | ttc | cgg | ccc | gac | ctg | atc | cac | gtg | gtc | aat | ccg | gct | gtg | ttg | ggg | 288 |
| Arg | Phe | Arg | Pro | Asp | Leu | Ile | His | Val | Val | Asn | Pro | Ala | Val | Leu | Gly | |
| | | | 85 | | | | | 90 | | | | | | 95 | | |

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| ttg | ggc | ggc | atc | tac | tat | gcc | aag | gcg | cta | aat | gtg | cca | ctc | gtg | gcg | 336 |
| Leu | Gly | Gly | Ile | Tyr | Tyr | Ala | Lys | Ala | Leu | Asn | Val | Pro | Leu | Val | Ala | |
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| gtc Val | ttg Leu 130 | gag Glu | ggg Gly | gtg Val | ctc Leu | tgg Trp 135 | gaa Glu | ttg Leu | ctg Leu | aag Lys | ctg Leu 140 | gcg Ala | cat His | aac Asn | caa Gln | 432 |
| gca Ala 145 | gcg Ala | atc Ile | aac Asn | ctc Leu | tgt Cys 150 | act Thr | tca Ser | acc Thr | gcg Ala | atg Met 155 | gtg Val | cag Gln | gag Glu | ctg Leu | aca Thr 160 | 480 |
| gat Asp | cac His | ggc Gly | att Ile | gag Glu 165 | cac His | tgt Cys | tgc Cys | ctc Leu | tgg Trp 170 | cag Gln | cga Arg | gga Gly | gtg Val | gat Asp 175 | acc Thr | 528 |
| gag Glu | acc Thr | ttt Phe | cgg Arg 180 | cca Pro | gac Asp | ttg Leu | gct Ala | act Thr 185 | gct Ala | gcg Ala | atg Met | cgc Arg | gat Asp 190 | cgc Arg | ctc Leu | 576 |
| agt Ser | ggc Gly | ggg Gly 195 | aag Lys | ccc Pro | act Thr | gcg Ala | ccc Pro 200 | ttg Leu | ttg Leu | ctc Leu | tac Tyr 205 | gtc Val | gga Gly | cgc Arg | ctc Leu | 624 |
| tca Ser | gcc Ala 210 | gag Glu | aag Lys | caa Gln | atc Ile | gat Asp 215 | cgc Arg | ctg Leu | cga Arg | ccc Pro | att Ile 220 | ttg Leu | gat Asp | gcc Ala | aat Asn | 672 |
| cct Pro 225 | gag Glu | gct Ala | tgc Cys | ttg Leu | gcc Ala 230 | ttg Leu | gtc Val | ggc Gly | gat Asp | ggc Gly 235 | ccg Pro | cat His | cgg Arg | gcc Ala | gaa Glu 240 | 720 |
| cta Leu | gag Glu | caa Gln | ttg Leu | ttt Phe 245 | gct Ala | ggc Gly | acc Thr | cag Gln | acg Thr 250 | cag Gln | ttc Phe | att Ile | ggc Gly | tat Tyr 255 | ctg Leu | 768 |
| cat His | ggg Gly | gaa Glu | cag Gln 260 | cta Leu | ggg Gly | gcg Ala | gcc Ala | tac Tyr 265 | gct Ala | tct Ser | gct Ala | gac Asp 270 | gct Ala | ttt Phe | gtc Val | 816 |
| ttt Phe | ccc Pro | tcc Ser 275 | cgg Arg | acc Thr | gaa Glu | acc Thr | ctc Leu 280 | ggg Gly | cta Leu | gtc Val | ttg Leu | ctg Leu 285 | gaa Glu | gcc Ala | atg Met | 864 |
| gca Ala 290 | gcg Ala | ggg Gly | tgt Cys | ccg Pro | gtc Val | gtg Val 295 | gcg Ala | gcc Ala | aat Asn | tcc Ser | ggg Gly 300 | ggc Gly | att Ile | ccc Pro | gat Asp | 912 |
| att Ile 305 | gtc Val | agc Ser | gac Asp | ggc Gly | att Ile 310 | aat Asn | ggg Gly | ttc Phe | ctg Leu | ttc Phe 315 | gat Asp | cct Pro | gag Glu | gat Asp | gaa Glu 320 | 960 |
| caa Gln | ggg Gly | gcg Ala | atc Ile | gct Ala 325 | gcg Ala | att Ile | cag Gln | cgc Arg | ttg Leu 330 | ttg Leu | gct Ala | aac Asn | cct Pro | gca Ala 335 | gag Glu | 1008 |
| cgc Arg | gag Glu | att Ile | cta Leu 340 | cgc Arg | caa Gln | gcg Ala | gct Ala | cgt Arg 345 | caa Gln | gaa Glu | gcc Ala | gaa Glu | cgc Arg 350 | tgg Trp | agc Ser | 1056 |

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Ser Gly Gly Lys Pro Thr Ala Pro Leu Leu Leu Tyr Val Gly Arg Leu
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Ser Ala Glu Lys Gln Ile Asp Arg Leu Arg Pro Ile Leu Asp Ala Asn
210 215 220

Pro Glu Ala Cys Leu Ala Leu Val Gly Asp Gly Pro His Arg Ala Glu
225 230 235 240

Leu Glu Gln Leu Phe Ala Gly Thr Gln Thr Gln Phe Ile Gly Tyr Leu
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His Gly Glu Gln Leu Gly Ala Ala Tyr Ala Ser Ala Asp Ala Phe Val
260 265 270

Phe Pro Ser Arg Thr Glu Thr Leu Gly Leu Val Leu Leu Glu Ala Met
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Ala Ala Gly Cys Pro Val Val Ala Ala Asn Ser Gly Gly Ile Pro Asp
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Ile Val Ser Asp Gly Ile Asn Gly Phe Leu Phe Asp Pro Glu Asp Glu
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Gln Gly Ala Ile Ala Ala Ile Gln Arg Leu Leu Ala Asn Pro Ala Glu
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Arg Glu Ile Leu Arg Gln Ala Ala Arg Gln Glu Ala Glu Arg Trp Ser
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| actctaggtg | tacccttggg | agtagacctc | cctgacagtg | aagacttaac | acttgctctgt | 2340 |
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| ctcacttcaa agttcaaagt ctcgaaggat cttctccaac tctctctaaa caagattcca | 120 |
| aattttcaaa ggtgaatttg tttgatagaa tcaagaacaa acctttaaa atg gcg cat | 178 |
| | Met Ala His |
| | 1 |
| cta ctt tca gct tca tgc cct tca qtt atc tca ctt agc agc agc agc | 226 |

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| | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Leu | Leu | Ser | Ala | Ser | Cys | Pro | Ser | Val | Ile | Ser | Leu | Ser | Ser | Ser | Ser | | |
| 5 | | | | | | 10 | | | | | 15 | | | | | | |
| agc | aag | aat | tca | gtt | aag | ccg | ttt | gtt | tca | ggg | cag | acc | ttc | ttc | aat | 274 | |
| Ser | Lys | Asn | Ser | Val | Lys | Pro | Phe | Val | Ser | Gly | Gln | Thr | Phe | Phe | Asn | 35 | |
| 20 | | | | | 25 | | | | | 30 | | | | | | | |
| gct | cag | ctt | ctt | tca | aga | tct | tct | ctc | aaa | gga | ctt | ctc | ttc | caa | gag | 322 | |
| Ala | Gln | Leu | Leu | Ser | Arg | Ser | Ser | Leu | Lys | Gly | Leu | Leu | Phe | Gln | Glu | 50 | |
| | | | | 40 | | | | | 45 | | | | | | | | |
| aag | aaa | ccg | aga | aaa | agc | tgc | gtt | ttc | aga | gca | act | gct | gta | cct | ata | 370 | |
| Lys | Lys | Pro | Arg | Lys | Ser | Cys | Val | Phe | Arg | Ala | Thr | Ala | Val | Pro | Ile | 65 | |
| | | | 55 | | | | 60 | | | | | | | | | | |
| acc | caa | caa | gca | cca | ccc | gaa | aca | tct | acc | aat | aac | tca | tcc | tct | aaa | 418 | |
| Thr | Gln | Gln | Ala | Pro | Pro | Glu | Thr | Ser | Thr | Asn | Asn | Ser | Ser | Ser | Lys | 80 | |
| | | 70 | | | | | 75 | | | | | | | | | | |
| cca | aag | cgt | gtt | atg | gtc | att | ggg | gga | gat | ggg | tat | tgc | ggg | tgg | gct | 466 | |
| Pro | Lys | Arg | Val | Met | Val | Ile | Gly | Gly | Asp | Gly | Tyr | Cys | Gly | Trp | Ala | 95 | |
| | 85 | | | | | 90 | | | | | | | | | | | |
| act | gct | ctc | cac | ttg | tcc | aag | aag | aat | tac | gaa | gtt | tgc | att | gtt | gac | 514 | |
| Thr | Ala | Leu | His | Leu | Ser | Lys | Lys | Asn | Tyr | Glu | Val | Cys | Ile | Val | Asp | 110 | |
| 100 | | | | | 105 | | | | | 110 | | | | | 115 | | |
| aac | ctt | gta | aga | cgt | ctt | ttc | gac | cac | cag | ctt | gga | ctt | gag | tca | ttg | 562 | |
| Asn | Leu | Val | Arg | Arg | Leu | Phe | Asp | His | Gln | Leu | Gly | Leu | Glu | Ser | Leu | 120 | |
| | | | | | 120 | | | | 125 | | | | | 130 | | | |
| act | cct | att | gcc | tcc | att | cat | gac | cga | atc | agc | cga | tgg | aag | gct | ttg | 610 | |
| Thr | Pro | Ile | Ala | Ser | Ile | His | Asp | Arg | Ile | Ser | Arg | Trp | Lys | Ala | Leu | 135 | |
| | | | 135 | | | | | 140 | | | | | 145 | | | | |
| aca | ggg | aaa | tca | att | gag | ttg | tac | gtt | ggg | gat | atc | tgt | gat | ttc | gaa | 658 | |
| Thr | Gly | Lys | Ser | Ile | Glu | Leu | Tyr | Val | Gly | Asp | Ile | Cys | Asp | Phe | Glu | 150 | |
| | | 150 | | | | | 155 | | | | | 160 | | | | | |
| ttc | tta | gct | gag | tct | ttc | aag | tct | ttt | gag | ccg | gat | tca | gtt | gtc | cac | 706 | |
| Phe | Leu | Ala | Glu | Ser | Phe | Lys | Ser | Phe | Glu | Pro | Asp | Ser | Val | Val | His | 165 | |
| | 165 | | | | | 170 | | | | 175 | | | | | | | |
| ttt | ggg | gaa | cag | aga | tcc | gct | cct | tac | tcg | atg | att | gac | cgg | tcc | aga | 754 | |
| Phe | Gly | Glu | Gln | Arg | Ser | Ala | Pro | Tyr | Ser | Met | Ile | Asp | Arg | Ser | Arg | 180 | |
| | | | | | 185 | | | | | 190 | | | | | 195 | | |
| gca | gtt | tat | aca | cag | cac | aac | aat | gtg | att | ggg | act | ctc | aac | gtt | ctc | 802 | |
| Ala | Val | Tyr | Thr | Gln | His | Asn | Asn | Val | Ile | Gly | Thr | Leu | Asn | Val | Leu | 200 | |
| | | | | 200 | | | | | 205 | | | | | 210 | | | |
| ttt | gct | ata | aaa | gag | ttt | gga | gag | gag | tgt | cat | ctt | gta | aaa | ctt | ggg | 850 | |
| Phe | Ala | Ile | Lys | Glu | Phe | Gly | Glu | Glu | Cys | His | Leu | Val | Val | Leu | Gly | 215 | |
| | | | 215 | | | | 220 | | | | | | 225 | | | | |
| acg | atg | ggg | gag | tat | gga | act | cca | aat | att | gac | atc | gag | gaa | ggg | tat | 898 | |
| Thr | Met | Gly | Glu | Tyr | Gly | Thr | Pro | Asn | Ile | Asp | Ile | Glu | Glu | Gly | Tyr | 230 | |
| | | 230 | | | | | 235 | | | | | 240 | | | | | |
| ata | acc | ata | acc | cac | aac | ggg | aga | act | gac | act | ttg | cca | tac | ccc | aag | 946 | |
| Ile | Thr | Ile | Thr | His | Asn | Gly | Arg | Thr | Asp | Thr | Leu | Pro | Tyr | Pro | Lys | 245 | |
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| | |
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| caa gct agc tcc ttt tat cat ctt agc aaa gtt cat gat tgc cac aac | 994 |
| Gln Ala Ser Ser Phe Tyr His Leu Ser Lys Val His Asp Ser His Asn | |
| 260 265 270 275 | |
| att gct ttt act tgc aag gct tgg ggt att aga gcc act gat ctc aac | 1042 |
| Ile Ala Phe Thr Cys Lys Ala Trp Gly Ile Arg Ala Thr Asp Leu Asn | |
| 280 285 290 | |
| caa gga gtt gtt tat gga gtg aag act gat gag aca gag atg cat gag | 1090 |
| Gln Gly Val Val Tyr Gly Val Lys Thr Asp Glu Thr Glu Met His Glu | |
| 295 300 305 | |
| gaa ctc cgt aac cga ctg gat tac gat gct gtg ttt ggt aca gca ctt | 1138 |
| Glu Leu Arg Asn Arg Leu Asp Tyr Asp Ala Val Phe Gly Thr Ala Leu | |
| 310 315 320 | |
| aac cgg ttc tgt gtg caa gct gct gtt ggt cac cca ctt aca gtt tat | 1186 |
| Asn Arg Phe Cys Val Gln Ala Ala Val Gly His Pro Leu Thr Val Tyr | |
| 325 330 335 | |
| ggt aaa ggt ggt cag acg aga ggc tac ctc gat ata aga gac acg gtt | 1234 |
| Gly Lys Gly Gly Gln Thr Arg Gly Tyr Leu Asp Ile Arg Asp Thr Val | |
| 340 345 350 355 | |
| caa tgt gtt gag atc gct ata gca aac ccg gca aaa gct ggt gag ttc | 1282 |
| Gln Cys Val Glu Ile Ala Ile Ala Asn Pro Ala Lys Ala Gly Glu Phe | |
| 360 365 370 | |
| cgg gtc ttc aac caa ttt aca gaa cag ttt tca gtc aat gaa ctg gct | 1330 |
| Arg Val Phe Asn Gln Phe Thr Glu Gln Phe Ser Val Asn Glu Leu Ala | |
| 375 380 385 | |
| tca ctc gtc act aaa gcg ggt tca aag ctt ggg cta gac gtg aaa aag | 1378 |
| Ser Leu Val Thr Lys Ala Gly Ser Lys Leu Gly Leu Val Lys Lys | |
| 390 395 400 | |
| atg acg gtg cct aac ccg aga gtg gag gca gaa gaa cat tac tac aac | 1426 |
| Met Thr Val Pro Asn Pro Arg Val Glu Ala Glu Glu His Tyr Tyr Asn | |
| 405 410 415 | |
| gca aag cac act aag ctg atg gaa ctt gga ctt gag cct cac tat cta | 1474 |
| Ala Lys His Thr Lys Leu Met Glu Leu Gly Leu Glu Pro His Tyr Leu | |
| 420 425 430 435 | |
| tct gac tca ctt ctt gat tgc ttg ctc aac ttt gct gtt cag ttt aaa | 1522 |
| Ser Asp Ser Leu Leu Asp Ser Leu Leu Asn Phe Ala Val Gln Phe Lys | |
| 440 445 450 | |
| gat cgt gtg gac acg aaa caa atc atg cct agt gtt tcc tgg aag aag | 1570 |
| Asp Arg Val Asp Thr Lys Gln Ile Met Pro Ser Val Ser Trp Lys Lys | |
| 455 460 465 | |
| att ggc gtc aag act aag tcc atg acc aca taa agtgcagacc aatattacac | 1623 |
| Ile Gly Val Lys Thr Lys Ser Met Thr Thr | |
| 470 475 | |
| ataaggagag attatgaaag agatgatgtg ttgttttggt tcttcaaact tcattttctgc | 1683 |
| aaaagacttg ctaggcttaa gaggttttgt ccatattaca ttgtgcaggt tctttaatgt | 1743 |
| tagatcttaa tttcgatgaa aaaaaaaaaa aaaaaaaaaa aaaaaagggc ggccgc | 1799 |

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35 40 45

Phe Gln Glu Lys Lys Pro Arg Lys Ser Cys Val Phe Arg Ala Thr Ala
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Val Pro Ile Thr Gln Gln Ala Pro Pro Glu Thr Ser Thr Asn Asn Ser
65 70 75 80

Ser Ser Lys Pro Lys Arg Val Met Val Ile Gly Gly Asp Gly Tyr Cys
85 90 95

Gly Trp Ala Thr Ala Leu His Leu Ser Lys Lys Asn Tyr Glu Val Cys
100 105 110

Ile Val Asp Asn Leu Val Arg Arg Leu Phe Asp His Gln Leu Gly Leu
115 120 125

Glu Ser Leu Thr Pro Ile Ala Ser Ile His Asp Arg Ile Ser Arg Trp
130 135 140

Lys Ala Leu Thr Gly Lys Ser Ile Glu Leu Tyr Val Gly Asp Ile Cys
145 150 155 160

Asp Phe Glu Phe Leu Ala Glu Ser Phe Lys Ser Phe Glu Pro Asp Ser
165 170 175

Val Val His Phe Gly Glu Gln Arg Ser Ala Pro Tyr Ser Met Ile Asp
180 185 190

Arg Ser Arg Ala Val Tyr Thr Gln His Asn Asn Val Ile Gly Thr Leu
195 200 205

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Asn Val Leu Phe Ala Ile Lys Glu Phe Gly Glu Glu Cys His Leu Val
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Lys Leu Gly Thr Met Gly Glu Tyr Gly Thr Pro Asn Ile Asp Ile Glu
225 230 235 240

Glu Gly Tyr Ile Thr Ile Thr His Asn Gly Arg Thr Asp Thr Leu Pro
245 250 255

Tyr Pro Lys Gln Ala Ser Ser Phe Tyr His Leu Ser Lys Val His Asp
260 265 270

Ser His Asn Ile Ala Phe Thr Cys Lys Ala Trp Gly Ile Arg Ala Thr
275 280 285

Asp Leu Asn Gln Gly Val Val Tyr Gly Val Lys Thr Asp Glu Thr Glu
290 295 300

Met His Glu Glu Leu Arg Asn Arg Leu Asp Tyr Asp Ala Val Phe Gly
305 310 315 320

Thr Ala Leu Asn Arg Phe Cys Val Gln Ala Ala Val Gly His Pro Leu
325 330 335

Thr Val Tyr Gly Lys Gly Gly Gln Thr Arg Gly Tyr Leu Asp Ile Arg
340 345 350

Asp Thr Val Gln Cys Val Glu Ile Ala Ile Ala Asn Pro Ala Lys Ala
355 360 365

Gly Glu Phe Arg Val Phe Asn Gln Phe Thr Glu Gln Phe Ser Val Asn
370 375 380

Glu Leu Ala Ser Leu Val Thr Lys Ala Gly Ser Lys Leu Gly Leu Asp
385 390 395 400

Val Lys Lys Met Thr Val Pro Asn Pro Arg Val Glu Ala Glu Glu His
405 410 415

Tyr Tyr Asn Ala Lys His Thr Lys Leu Met Glu Leu Gly Leu Glu Pro
420 425 430

His Tyr Leu Ser Asp Ser Leu Leu Asp Ser Leu Leu Asn Phe Ala Val
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Gln Phe Lys Asp Arg Val Asp Thr Lys Gln Ile Met Pro Ser Val Ser

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450

455

460

Trp Lys Lys Ile Gly Val Lys Thr Lys Ser Met Thr Thr
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 gaattggggg ttcagtcctt cactccgata gcgacgattg aacgccgggt gaaggcatgg 180
 caagaaacgg gcgggcagcc gattagcttt gtcaatctcg acttagcggc tgattacgat 240
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 ttctactact acaacaagaa cgacaacatc caagtcaccg accttcacca gggattgtgc 660
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35 40 45
Pro Ile Ala Thr Ile Glu Arg Arg Leu Lys Ala Trp Gln Glu Thr Gly
50 55 60
Gly Gln Pro Ile Ser Phe Val Asn Leu Asp Leu Ala Ala Asp Tyr Asp
65 70 75 80
Arg Leu Cys Ala Leu Leu Leu Glu Thr Gln Pro Asp Ala Ile Val His
85 90 95
Phe Ala Glu Gln Arg Ala Ala Pro Tyr Ser Met Lys Ser Ala Trp His
100 105 110
Lys Arg Phe Thr Val Asn Asn Asn Val Asn Ala Thr His Asn Leu Leu
115 120 125
Cys Ala Cys Val Asp Val Gly Leu Lys Ser His Ile Val His Leu Gly
130 135 140
Thr Met Gly Val Tyr Gly Tyr Gly Ser His Arg Gly Ala Thr Ile Pro
145 150 155 160
Glu Gly Tyr Leu Glu Val Glu Val Val Gln Arg Asp Gly Gln Arg Phe
165 170 175
Glu Glu Lys Ile Leu His Pro Val Asp Pro Gly Ser Val Tyr His Met
180 185 190
Thr Lys Thr Leu Asp Gln Leu Leu Phe Tyr Tyr Tyr Asn Lys Asn Asp
195 200 205
Asn Ile Gln Val Thr Asp Leu His Gln Gly Ile Val Trp Gly Thr Asn
210 215 220
Thr Asp His Cys Asn Leu His Pro Asp Leu Thr Asn Arg Phe Asp Tyr
225 230 235 240
Asp Gly Asp Tyr Gly Thr Val Leu Asn Arg Phe Leu Met Gln Ala Ala
245 250 255
Ile Gly Tyr Pro Leu Thr Val His Gly Val Gly Gly Gln Thr Arg Ala
260 265 270
Phe Ile His Ile Arg Asp Ser Val Arg Cys Val Gln Leu Ala Ile Glu
275 280 285

Asn Pro Pro Ala Ala Asn Glu Lys Val Arg Ile Phe Asn Gln Met Thr
 290 295 300
 Glu Thr Tyr Gln Val Lys Asp Leu Ala Glu Lys Val Ala Ala Leu Thr
 305 310 315 320
 Gly Ala Glu Ile Ala Tyr Leu Pro Asn Pro Arg Lys Glu Ala Leu Glu
 325 330 335
 Asn Asp Leu Ile Val Asp Asn Arg Cys Leu Ile Asp Leu Gly Leu Asn
 340 345 350
 Pro Thr Thr Leu Asp Asn Gly Leu Met Ser Glu Val Val Glu Ile Ala
 355 360 365
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Leu Arg

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